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ENDGAMES

CASE REPORT

Indications for and use of inferior vena cava filters in the preoperative phase

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A 66 year old man presented for preoperative assessment and optimisation before a left thoracoabdominal oesophagectomy for oesophageal adenocarcinoma (T3N2). He had undergone three cycles of chemotherapy and developed a deep vein thrombosis in the right popliteal vein. He was started on low molecular weight heparin. His medical history included deep vein thrombosis of the right leg and pulmonary embolism four years ago, myocardial infarction, hypertension, and hypercholesterolaemia.

His history of venous thromboembolism and high ongoing thrombotic risk meant that lifelong anticoagulation was indicated. The need for surgery made it necessary to interrupt therapeutic anticoagulation within two months of his venous thromboembolism. Repeat Doppler scans of the right leg undertaken as part of the preoperative assessment and optimisation process showed residual thrombosis.

Questions

1 How should patients with previous venous thromboembolism be managed preoperatively?

2 When are inferior vena cava filters indicated?

3 What is the evidence for inferior vena cava filters *v* routine anticoagulation in preventing primary or recurrent pulmonary embolism?

4 What complications are associated with inferior vena cava filters?

5 When should inferior vena cava filters be removed?

Answers

1 How should patients with previous venous thromboembolism be managed preoperatively?

Short answer

Preoperative management depends on the history of venous thromboembolism, the patient's risk profile, the type of surgery that is planned, and the patient's renal function. All patients at risk of venous thromboembolism should be prescribed antiembolic stockings and pharmacological thromboprophylaxis unless contraindicated.

Long answer

The importance of thromboprophylaxis in preventing deep vein thrombosis was established more than three decades ago.[1] Because deep vein thrombosis can lead to fatal pulmonary embolism—the most common preventable risk factor for inpatient mortality[2]—perioperative thromboprophylaxis has become the norm in at risk patients. Current National Institute for Health and Care Excellence (NICE) guidelines suggest that any patient at risk of venous thromboembolism (for example, previous venous thromboembolism, cancer surgery, age over 60 years, or serious comorbidity) should be prescribed antiembolic stockings and thromboprophylaxis. Those with normal renal function should be prescribed low molecular weight heparin (0.5 mg/kg once daily), which should be omitted 12 hours before surgery. Those with an estimated glomerular filtration rate below 30 mL/min should be given unfractionated heparin 5000 units subcutaneously three times a day, which again should be omitted eight hours before surgery. Insertion of an inferior vena cava filter should be considered in those at risk of venous thromboembolism in whom drug treatment is contraindicated.

For patients with more complex problems, the American College of Chest Physicians (ACCP) provides an algorithm for risk

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stratification and treatment based on the type of surgery planned and the patient's risk factors.[3] According to this classification, general surgery is associated with moderate risk, patients undergoing surgery for cancer are higher risk, and major orthopaedic surgery is associated with the highest possible risk. These guidelines help identify patients who require thromboprophylaxis after hospital discharge, such as orthopaedic patients.

2 When are inferior vena cava filters indicated?

Short answer

The most common indication is in patients with acute pulmonary embolism or deep vein thrombosis who are due to undergo major surgery within two months of venous thromboembolism. The second most common reason is venous thromboembolism in a patient with a contraindication to anticoagulation.[4]

Long answer

Inferior vena cava filters are mechanical adjuncts implanted into the inferior vena cava to prevent emboli originating in the leg veins migrating to the pulmonary vasculature, where they can be life threatening. Filters have been in use since 1967 and were initially designed to be placed within the inferior vena cava permanently.[5 6] However owing to the complications and risks involved with their implantation, their role is now limited to cases in which anticoagulation is not possible or is inadequate on its own. More controversial indications for the use of these filters include prophylactic insertion in those at high risk of deep vein thrombosis from surgery or trauma and in those with deep vein thrombosis who have burns, cancer, or are pregnant.[7-9]

NICE and the ACCP recommend using these filters mainly in the following patients:

- Patients with acute pulmonary embolism or deep vein thrombosis who have residual deep vein thrombosis and who have a contraindication to anticoagulation
- Those with recurrent proximal deep vein thrombosis or pulmonary embolism despite adequate anticoagulation
- Those with acute pulmonary embolism or deep vein thrombosis who are due to undergo major surgery within two months of venous thromboembolism[10]

The British Society of Interventional Radiology collated information on the placement of 1255 inferior vena cava filters at 68 centres in the United Kingdom between January 2008 and December 2010. The resulting inferior vena cava registry report (2011) showed that the most common reason for filter insertion was preoperatively in patients with deep vein thrombosis or pulmonary embolism (30.3%), followed by patients with contraindications to anticoagulation (25.6%).[4] The table⇓ provides a breakdown of the indications for filter insertion.

3 What is the evidence for inferior vena cava filters *v* routine anticoagulation in preventing primary or recurrent pulmonary embolism?

Short answer

There is no evidence to support the use of vena cava filters over drug treatment. The use of these filters in addition to routine anticoagulation is associated with a significantly reduced incidence of pulmonary embolism, but an increased risk of deep vein thrombosis, and no overall survival benefit. The general consensus remains that mechanical intervention should be used only when no pharmacological alternative is available.

Long answer

The only randomised controlled trial in this area compared the use of filters and anticoagulation versus anticoagulation alone in preventing pulmonary embolism. It found a significant reduction in pulmonary embolism (1.1% in filter group *v* 4.8% without filters at 12 days postoperatively; odds ratio 0.22, 95% confidence interval 0.05 to 0.90), but an increased risk of deep vein thrombosis and no overall survival benefit.[11 12] An increased risk of deep vein thrombosis with filter insertion had previously been described in a population based study[13]

Consensus remains that filters have no overall therapeutic benefit over anticoagulation in preventing pulmonary embolism in uncomplicated patients. The Cardiovascular and Interventional Radiology Society of Europe, ACCP, and NICE advise limiting the use of filters to patients in whom no pharmacological alternative is available.

4 What complications are associated with inferior vena cava filters?

Short answer

Insertion is generally a safe procedure with a low major complication risk.[14] Potential complications of inferior vena cava filters are recurrent deep vein thrombosis, migration of the filter, and inferior vena cava thrombosis.

Long answer

A retrospective study of 400 patients with inferior vena cava filters found deep vein thrombosis of the ipsilateral limb (the most common complication from inferior vena cava filter placement) in 15 (3.8%) patients and migration in six (1.5%) patients. However, in this single centre study, inferior vena cava thrombosis rates were high at 19 (4.75%).[15] Since 2005, the US Food and Drug Administration has received 921 device adverse events associated with vena cava filters. Of these, the most common complications were filter migration (328), detachment of device components (146), and inferior vena cava perforation (70).[16] It must be noted, however, that those cited in the FDA report are subject to selection bias depending on the cases reported.

Despite filter insertion being a relatively safe procedure, most of the problems in the acute phase are associated with further venous thromboembolism and migration of the filter. Although the venous thromboembolism does not require further management, migration of the filter can necessitate surgical intervention, which in itself carries inherent risks. It is therefore thought that inferior vena cava filters should be considered only when routine anticoagulation is contraindicated and risk of haemodynamically significant pulmonary embolism exists.

5 When should inferior vena cava filters be removed?

Short answer

Inferior vena cava filters should be removed as soon as placement is no longer needed, usually 10-14 days after insertion and no longer than six months after. Doctors who implant such devices are advised to ensure adequate follow-up after implantation and to refer patients for removal when feasible.

Long answer

The general consensus among doctors is to consider filter removal once protection from pulmonary embolism is no longer needed. The Medicines and Healthcare Products Regulatory

Agency (MHRA) and FDA now recommend that the doctor who implanted the filter should be responsible for ensuring ongoing care after implantation and for referring the patient for filter removal once this is feasible and clinically indicated.[17 18] The main reasons for removal are to mitigate filter related complications, such as deep vein thrombosis, filter migration, and inferior vena cava thrombosis.

Retrieval recommendations depend on the manufacturer and the type of filter being used. Although filters may remain viable for many years, it is generally advised that they are retrieved 10-14 days after insertion,[19] with the ACCP recommending that filters be kept no longer than six months after placement.[20] Despite this, retrieval rates continue to be as low as 15%,[21] with reasons including the doctor refusing to remove the filter, age, and prolonged immobility.[22]

Patient outcome

An inferior vena cava filter was inserted before our patient's scheduled surgery. He was followed up by the surgical team after a successful operation and the filter was subsequently removed. He made a good recovery and has been started on lifelong anticoagulation.

Competing interests: We have read and understood the BMJ Group policy on declaration of interests and declare the following interests: None.

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Patient consent obtained.

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Table

Table 1| Indications quoted by British Society of Interventional Radiology for inferior vena cava filter placement. Reproduced with permission from publishers of the first UK inferior vena cava filter registry report 2011 (British Society of Radiology)[4]

Indication	No of patients (total 1255)	Percentage
Pulmonary embolism despite anticoagulation	137	11.0
Pulmonary embolism with contraindication to anticoagulation	318	25.6
Deep vein thrombosis or pulmonary embolism plus limited cardiopulmonary reserve	61	4.9
Deep vein thrombosis with high risk of embolism	165	13.3
Paradoxical emboli	4	0.3
Deep vein thrombosis with contraindication to anticoagulation	228	18.4
Adjunct to lysis	14	1.1
Prophylaxis in a high risk patient	261	21.0
Preoperative use in acute deep vein thrombosis or pulmonary embolism	376	30.3
Pregnant patient with deep vein thrombosis or pulmonary embolism	25	2.0
Other	95	7.6
Unspecified	13	—